

PAM 622,323 (X40)

Pam 622.323 : (X40)



LEMMING & FLOWERS AT ALERT, NORTH END OF ELLESMERE IS., CANADA'S MOST NORTHERLY POINT - 80 SPECIES VEGETATION, INCLUDING BLUEBELLS & ARCTIC POPPIES.

TRANS-WESTERN OILS LIMITED (N.P.L.)

ARCTIC ISLANDS PROJECT

ECONOMIC NOTES



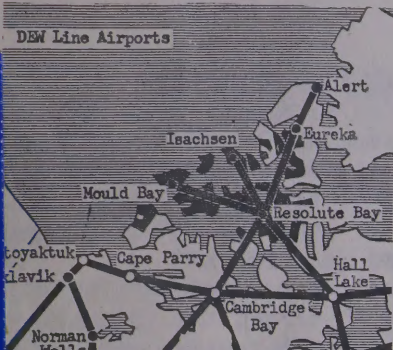
MUSKOXEN OF HERDS ON MELVILLE & OTHER ISLANDS



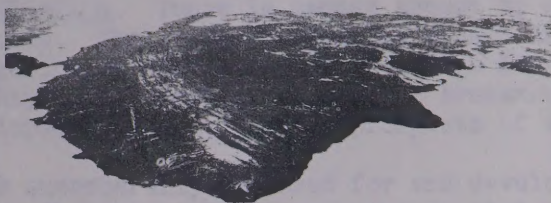
PRINCE PATRICK ISLAND CARIBOU



SEAL ALERT SIGNIFIED FROM NORTH POLE



FIN. POST MAR.14/59



LOOKING WEST OVER S. E. CORNER OF T.-W.'S CAMERON ISLAND, NORTHERMOST ISLAND T.-W.'S BATHURST GROUP. PARRY FOLDS ON LEFT AND COASTAL PLAIN ON RIGHT.



SEAL ALERT SIGNIFIED FROM NORTH POLE

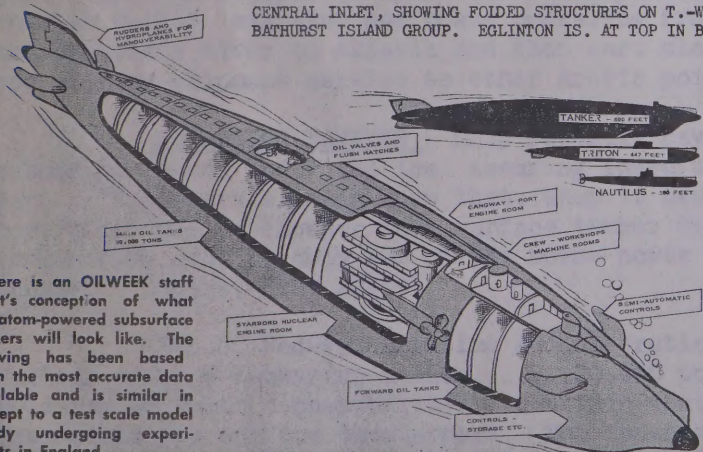


The town of Aklavik, Canada's most northerly community, on the shores of the Arctic ocean a main supply centre for the north and familiar to northern geologists. OILWEEK, APR 3, 59

T.-W.'S WYANDOT ISLAND ON LEFT AND WHITEWOOD ON RIGHT OF CENTRAL INLET, SHOWING FOLDED STRUCTURES ON T.-W.'S BATHURST ISLAND GROUP. EGLINTON IS. AT TOP IN BACKGROUND.



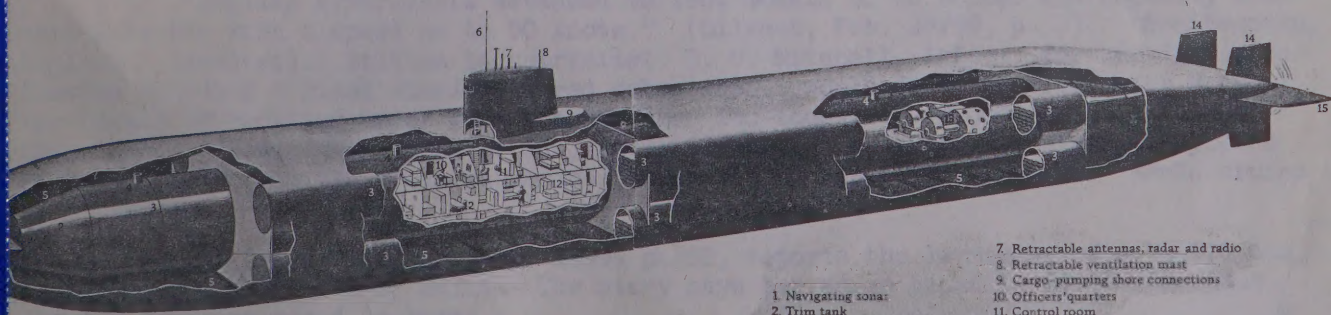
PIERCEMENT DOME (SALT DOME) IN SVERDRUP BASIN OF CANADIAN ARCTIC ISLANDS.



Here is an OILWEEK staff artist's conception of what an atom-powered subsurface tanker will look like. The drawing has been based on the most accurate data available and is similar in concept to a test scale model recently undergoing experiments in England.

OILWEEK February 27/59

PLANS FOR U.S. MARITIME ADMINISTRATION OF 565 FOOT SUBMARINE TANKER. (NAT. GEOGRAPHIC, JAN. 1959) COMMANDER ANDERSON, U.S.S. NAUTILUS IS QUOTED, "I DO NOT KNOW OF ANY PRACTICAL LIMIT IN SIZE. THE JAPANESE....ARE STUDYING A 100,000 TON DESIGN."



- 1. Navigating sonar
- 2. Trim tank
- 3. Variable cargo tank
- 4. Access and escape trunks
- 5. Main cargo and ballast tank
- 6. Periscope
- 7. Retractable antennas, radar and radio
- 8. Retractable ventilation mast
- 9. Cargo-pumping shore connections
- 10. Officers' quarters
- 11. Control room
- 12. Crew's quarters
- 13. Engine room
- 14. Rudder
- 15. Diving plane

LIBRARY BOREAL INSTITUTE

JAN 18 1961

POLAR PAM 4383 POLAR PAM







NOTES ON ECONOMICS OF OIL AND GAS IN CANADIAN ARCTIC ISLANDSINTRODUCTION

Canada's Arctic Islands - The Queen Elizabeths - hold promise of prolific production of oil and gas at low cost per unit, and appear to have economic advantages greater than any other comparable exploratory area. It now appears that they are not remote and that the climate is no problem.

ACCESSIBILITY AND TRANSPORTATION

SURFACE SHIP NAVIGATION. There is summer access by surface ships to most of the Queen Elizabeth Islands. The summer navigation season is of two to five months' duration. Some years navigation is open all winter through Barrow Strait and Lancaster Sound to Baffin Bay. "Development of new ice breakers - including atomic ice breakers reported developed by Russia - offer prospects of increasing the accessibility of the islands.

The industry has successfully explored for and developed reserves in areas presenting problems in accessibility at least as great as that posed by the ice conditions of the Arctic." (Oilweek, Feb. 27/59). The appended map shows routes which have been navigated by ship.

"Break-up begins along Barrow Strait in late July or early August, and a little later, further north. Open water normally prevails there and in Wellington Channel, and Jones Sound in August and September. In Viscount Melville Sound..... South closes, generally leaving a wide lane along the north side of the Sound through which many vessels have sailed safely westward to Melville Island." (Taylor, Vol. A", p. 42).

Surface tankers could find a number of suitable harbours in most of the islands, and which can be reached by ice-free channels in the summer months.

Among the shipping companies offering service is one which advises "We have had ships freighting in the Arctic the last dozen years for the U.S. Navy and for Canada's Mines and Technical Surveys Branch .....one equipped with large helicopter pad." Another advises it operates its ships from Vancouver to all the Western Arctic coastal points, and also has boats operating from Hay River on Great Slave Lake via the Mackenzie River to Aklavik and then east along the Arctic Coast to Tuktoyaktuk, and a trans-shipment service to other Arctic points.

SUBMARINE TANKERS. Only recently have we seen the dramatic advances made in submarine travel under the ice, assuring these islands of year-round access and transport. "Engineers already know that, when it becomes developed, submarine tanker transportation will be cheaper than surface tanker transportation of crude. A submarine tanker will require only 40% of the horse power required for a comparable sized surface tanker." (Myers, Feb. 20/59).

"U. S. Federal Maritime Administration has contracted for a study of possible nuclear powered submarine tanker.....20,000 to 40,000 tons carrying capacity ..... believes 40 knots a possibility. To attain that speed would require far less power than would its surface counterpart. The Japanese .... studying 100,000 ton design." Reports of the officers of the U.S.S. Nuclear Submarine Nautilus, as published in the January, 1959 edition of the National Geographic.)

"English experiments advanced to test models of an 80,000 ton capacity submarine tanker with a speed up to 50 knots." (Oilweek, Feb. 27/59, p. 3). "Southampton, England. (Reuters). British Industrialist, E. D. Mitchell, left....for Canada.... to discuss building a giant atomic powered submarine....would increase trade with northern Canada by cruising under Hudson's Bay when ice-bound.....50,000 tons..... 600 feet long." (News item Vancouver Sun, April 10/59). The Albertan, Calgary, reported on March 30/59 that the above submarine tanker "to be named the Moby Dick" would cruise at 25 knots.

Oil & Gas World of March 1959, p. 52, reports the launching of a 70,000 ton tanker as the largest ever built. The story says her cargo capacity is 610,500 bbls. and her cruising speed 16 knots.

"Subs can punch through the North Polar icecap. Nuclear subs will be able to maneuver effectively under Arctic ice regardless of the season. The Navy announced







Friday that the U. S. S. Nuclear Submarine Skate had completed a twelve day voyage under the icecap." (John Averill, A.P., Vanc. Sun, Mar.27/59).

".....the shelf.....extends between 50 and 100 miles from the (Arctic) Islands, and the Beaufort Sea has depths down to 4000 feet." (Arctic Canada from the Air, p. 441). It seems evident therefore that there will be deep water access by submarine to most of the Queen Elizabeth Islands via local channels.

"Science's greatest contribution to the (Arctic) transportation problem will be in the field of under-sea craft. The vessels will mean that the whole Arctic will have access to the shipping lanes of the world (and of Canada). Thus Canada will have on three oceans the longest coast line of any country in the world." (Alex Hemstock, Research Engineer, Imperial Oil, speaking to Rotary at Edmonton, as reported by Radio Station C.F.C.N., Calgary, April 2/59).

"Nautilus cruised more than 20 miles per hour, 1839 miles beneath the Polar ice. Deeper channels (i.e. deeper than to the Pacific) to the Atlantic serve the whole Archipelago. Down below it is always calm....no vibration....no fog, storms or seasickness. Barrow Submarine Canyon drops abruptly to 5700 ft. at the western end of the Trans-Arctic Seaway, in which the Nautilus and Skate sailed in safe water with depths from 6000 to 13,000 feet. Four-tenths of the surface was open water. Thus was reported 'the opening of a trade route for rapid voyages between the great Pacific and Atlantic oceans - a truly practicable northwest passage.'"

"On August 5/58 the ship ran into open water...." "This about 600 miles from the North Pole east of Greenland and in the warm Gulf stream. We found that this (Arctic) was a very deep ocean, with deep approaches from the Atlantic side, shallower avenues in from the Pacific side.

Commercial submarines....would shave great distances....Tokyo to London. Normally 11,200 miles .....Polar passage.....6,500 miles. Seattle to Oslo 9,300 miles, but an Arctic sub would travel only 6,100 miles. Arctic may be easier to negotiate in lead of winter than in spring or summer." (From the foregoing it appears the Polar ice does not extend very far south on the European side of the trans-polar route.)

"It has gradually become apparent that the Polar Sea lies in a deep basin, its floor broken only by occasional under-water hills and ledges, and one long under-water mountain range." (Reports of the officers of the Nautilus. Life Magazine, Feb. 1959, p. 60.)

There is no physical reason apparently why such submarine tankers could not deliver oil deep into the heart of the North American Continent via the St. Lawrence Seaway.

The long ton of 2240 lbs. equals 6 barrels of oil and the short ton of 2000 lbs. equals 5.6 barrels. Thus an 80,000 ton tanker could transport 480,000 barrels of oil, if those are long tons and if that is "cargo tonnage." If it is "gross tonnage" then the cargo estimate should be reduced by about 15%. Other estimates indicate more barrels can be carried.

UNDER-ICE NAVIGATIONAL INSTRUMENTS. The fathometer - a sonar device measures distances to the bottom; echo finders - the distance to ice above; television camera shows the passing ice formation and the "inertial navigator performs like a champion." (Nautilus Reports.)

### PIPELINES

"They're (i.e. big operators) talking about pipelines to Arctic seaports which tankers could reach during a few weeks each summer. But they are also saying that atomic submarine tankers could sail under the Polar ice.....and deliver Arctic oil to North America and Europe the year round." (Gerald Waring in the Vanc.Sun, Feb. 23/59). As pipelines doubtless would be required in full development of the Arctic Sedimentary basin, the example of "Pluto" is recalled. In this operation during the second world war, lines of submarine pipe were laid across the English Channel. Now we find that submarine flexible pipe is being laid in the Gulf of Mexico by Shell. (International Oilman, April 1959, p.116). Then we read of the proposal to lay such a pipeline across the straits of Georgia from the mainland at Vancouver to Vancouver Island. (International Oilman, Sept. 1957, p. 304). Thus pipelining can doubtless be applied where necessary in the Arctic Islands.







### COMPARATIVE OIL SHIPMENT COSTS.

Published comment by the industry indicates a general acceptance that it is more economic to transport crude oil by surface tanker than by pipeline, and as available data indicates that submarine tankers can be built with 20% less metal in their hulls and using atomic power, with 15% less space taken up for fuel tanks, and operate at lower costs, and at higher speeds with less danger than sailing on the surface, that oil could be transported under the ice more economically than on the surface of the sea.

The following compares pipeline tariffs with surface tanker spot tariffs. The Interprovincial Pipeline, Redwater, Alberta, to Port Credit, Ontario - 1931 miles, charges 60¢ per barrel for that distance, or approximately 3 cents per barrel per 100 miles. Spot tanker rates over the period since the disruption caused by the blocking of Suez and subsequent troubles, average 66¢ per barrel from Persian Gulf to U. K., a distance of about 8,000 statute miles, which rate approximates 4/5ths of a cent per 100 miles.

Thus oil moves much cheaper by tanker than by pipeline.

The estimated distance from Melville Island in the Arctic to Southampton via the North Pole is 3,300 miles. Evidently Arctic crude would have an advantage over Persian Gulf oil in European markets. A submarine tanker getting the same tariff per 100 miles would have a cushion of 39.6¢ per barrel in carrying Arctic oil to U. K. as against Persian Gulf oil.

### LAND VEHICLE TRANSPORT

The terrain of the Parry Islands, including the Parry Islands Fold Belt, the Verdrup Basin, and the Arctic Coastal Plain, are non-mountainous, and for the most part comprised of level benches and plateaux. (See map Fig. 79 at p. 398 of Ec.Geol.). It is stated that all parts of Trans-Western's lands can be reached within half a mile in every instance by jeep and tracked vehicles. Some references indicate that summer road would be quite severe. It is suggested that as rock outcrops everywhere, road making should not be difficult. There is no muskeg.

Moving material over the surface no doubt would be less costly in the Arctic Islands than in the muskeg areas of the North West Territories. It is reported in Oilweek, Apr.3/59, p.26, that summer roads in muskeg country can cost up to \$10,000. per mile, while winter roads cost from \$200.00 to \$600.00 per mile.

### EXPLORATION.

Conditions favour some phases of exploration. The widespread rock outcrop facilitate geology, which again is made more effective by the very low precipitation. Climatic conditions are good except for fog in the short midsummer season. Heavy equipment can be moved by sea to convenient depots. Aircraft are frequently used on the most northerly islands to freight heavy loads.

".....in the .....Arctic Islands oil findings costs, once the problem of distance and transportation have been solved, may be even lower than on the southern plains." (Oilweek, Apr.3/59, p.21).

### AERIAL PHOTOGRAPHY

Some 30,000 trimetrogon pictures are available in the Department at Ottawa. Andrew Taylor, P.E., made a quick examination of these in connection with his various writings. Aerial photography began in 1949. (Taylor, Vol."A", pp 80-81).

### AEROMAGNETIC SURVEY.

In 1955 an airborne magnetometer survey was made that covered the whole Arctic Archipelago. This is shown in Fig. 2 of "Geological Unity of Arctic Islands", by Fortier and Morley) and is incorporated in the map appended to these notes.

### AIR TRANSPORT, AIRPORTS, ETC.

There is a network of air routes and flying stations or airports throughout the Queen Elizabeth Islands. (See Airports map on front page.) Flying boxcars and other







avy freight planes cover the area.

It was reported in the Calgary Herald of Apr. 27/59, that four flying boxcars the R.C.A.F. Transport Command, had completed the supply of Canada's weather stations within the Arctic Circle. These C-119's carried a million pounds of cargo in less than six weeks, flying 70,000 miles, and also took in rotation crews. Bases supplied included Resolute Bay on Cornwallis Island, Alert on the northern tip of Ellesmere Island, 550 miles from the North Pole, Isachsen on Ellef Ringnes Island, Eureka on Axel Heiberg Island, and Mould Bay on Prince Patrick Island. There are wireless installations at all these and other weather, R.C.A.F. and R.C.M.P. stations in the islands.

"Landing of aircraft presents virtually no problem. Winged aircraft can make wheeled landings on the beaches, or ski equipped planes can land on the ice." (J. M. Harrison, Director of Geological Survey, quoted in Oilweek Mar. 6/59, p. 48).

The Financial Post on March 14/59 reported that "It is planned to open to civilian aircraft the R.C.A.F. station at Resolute; that the Department of Transport would take over the D.E.W. airstrip at Cambridge Bay, and that the same procedure would certainly follow at Isachsen, Mould Bay, Eureka and Alert; that a dozen more similar stations and depots were planned for the next three years."

"Visibility in summer is often curtailed by fog ..... best (visibility) in winter, especially in April." (Taylor's Brochure, p. 6.)

For summer use, Canso Amphibians have been recommended. For trans-shipment DC-3's are preferred by some, on skis in winter, and wheeled in summer.

#### FLYING AND OTHER SERVICE.

One aircraft company offers to supply between June 15th and September 15th catered accommodation and meals at Resolute in buildings to be set up there; to service aircraft at that point; to maintain direct radio contact between forward camps and company offices everywhere. The company will be making weekly flights from Frobisher Bay to Resolute, at which depot it will supply aviation fuel.

Another aircraft company offers constant flights to all D.E.W. stations and weather stations. It will fly cargos of 17,000 lbs. from Montreal to Alert, Resolute, and other such station. It can accommodate 50 to 60 passengers per flight in DC-4's, and DC-3's 20 to 28 passengers or 6,000 lbs. of freight. The company also has P.B.Y. - 5 amphibians that accommodate 6,000 lbs. or 19 passengers.

#### CONSTRUCTION

One Montreal engineering firm which has built weather stations as far north as Alert, 525 miles from the North Pole and 300 miles further north than Trans-Western's northernmost land, offers to design and supervise the building of installations anywhere in the Arctic Islands. Factors contributing to satisfactory construction costs are the level terrain, the accessibility to shipping of main depots, the feasibility of landing cargo planes almost anywhere in the relevant areas, and the weather conditions are not so severe as some northern continental points.

#### LAND COST

It is reported in Oilweek of April 3/59 that in March, sales of reservations in the North West Territories covering 2,877,077 acres, averaged \$2.69 per acre. The top price was \$8.26 per acre. This was reported to be all "completely virgin land."

On the basis of \$2.69 per acre, 5¢ of work per acre for the first eighteen months, and 25¢ of work per acre for the second eighteen months, the cost per acre per year for the first three years is \$1.00, as against 1.83 cents per acre in respect to government fees and work requirements, for land in the Arctic Islands, on the basis of the anticipated amendments to regulations, and before including monetary consideration to Trans-Western. Thus land probably no better costs 54 times as much for the first three years.

#### CLIMATE

TEMPERATURE. "Although high in latitude, the Queen Elizabeth Islands have been bequeathed a climatic reputation undeserved in severity. Meteorological data are gradually correcting the false impression as the facts about the Islands' climate are







coming known. Summers are cool, but remarkably uniform. July daily maximum temperatures average about 45° F., with the minimum about 10° lower." (Taylor's Brochure, p.16).

By way of comparison, here are some temperatures in degrees Fahrenheit, and except as otherwise noted, supplied by the Meteorological Office, Dominion Government and as to Mean Maximum and Mean Minimum, on the basis of monthly averages compiled since records started:-

PLACE	MEAN MAXIMUM	MEAN MINIMUM	AVERAGE EXTREME LOWS FOR JANUARYS.	ABSOLUTE EXTREME LOWS.
Mould Bay, Prince Patrick Is. (Paper 55-5 Geol.Sur. Summarizing 1948-50).	6.3	-6.6	-42 (lowest ex- treme 1948-1950)	-60 (Taylor's Broch- ure, p. 16)
Umanag, Y. T.	34	10	not available	-84
Winnipeg,	46	24	-37	-54
Edmonton,	51	27	-27	-49
Edmonton City, Y.T.	34	14	-52	
Fort Norman, N.W.T.	30	10		-58
On Mackenzie River south of Arctic Circle)				
Umanag, N.W.T.	24	8		-55
Umanag Plateau, Y.T.				-60 (Oilweek Apr.3/59)
Edmonton Lake, B.C.	38	17	-44	-56
Umanagmine, Arctic	18	4	-45	-47
Coast, N.W.T.				
Umanag River, Great Slave				
Umanag, N.W.T. (near Alberta border.)	34	14	-51	

WINDS. Mean annual winds at various Arctic Island stations in miles per hour, are as follows:-

Eureka	7.0	Mould Bay	9.7	Toronto	11.4
Isachsen	8.7	Resolute	10.6		

thus no more windy than the rest of Canada." (Taylor, Vol. "B", p. 26)

PRECIPITATION. Annual precipitation is as follows:-

Mould Bay & Asachsen	less than 3 inches	Winnipeg	21.0 inches
Eureka	1.74 inches	Vancouver	57.0 inches

thus the area is as dry as some deserts." (Taylor Vol. "B", p. 23)

#### TIDES

In the Western Arctic these are very small. In Byam Channel between Bathurst Land and Melville Island the spring tide was measured at 1 foot, and the neap tide was zero. (Taylor Vol. "A", p. 41) The tides are greater in the eastern Arctic.

#### ICE

Trans-Western's lands and the islands on which they are situated are free of ice. Some of the reports state that there are some small areas of permanent ice on Melville Island, but these occurrences are stated by Andrew Taylor in those excerpts from his 12 volumes which Trans-Western has collected as its Volume "B", at page 14, to be snow and not ice.

Sea ice is from 6 to 8 feet thick. (Taylor's Brochure, p. 2) "The sort of solid ice which covers land at the South Pole does not exist at the top of the world. Only a relatively thin scum of ice covers the Polar Sea, and it is seldom more than 12 feet thick." (Reports of officers of Nautilus in Life, January 1959, p. 60).

Oceanic shelf ice breaks up in the swifter channels in June or July and the freeze-up occurs in October. (Taylor's Brochure, p. 2) This ice is stated to be more usually about 6 or 7 feet thick. (Arctic Canada from the Air, p. 448).

Trans-Western's lands are snow free during the summer period.







### SHELF DRILLING

Operators familiar with off-shore drilling say that the stable, thick shelf ice in the broad reaches of the enclosed seas, where free from fast currents, will serve as a raft for drillsites.

### ECONOMIC MINERALS

The prospects for discoveries of oil and gas are dealt with in Trans-Western's Notes on Geology.

OIL AND GAS. "The petroliferous nature of some formations, the varied lithologies and structures and the wide distribution in time and space and the substantial volume of fossiliferous strata are reasons for considering the Arctic Archipelago as a potential source of oil and gas." (Y.O. Fortier, Geological Survey, 1957, p. 14).

"..... geologists on the spot (i.e. on Queen Elizabeth Islands) have made no bones about their belief that substantial deposits of gas and oil lie under the islands, and along the continental shelf under the Arctic waters, lying off the islands." (C.P. News, datelined Ottawa, commenting on report by Hon. A. Hamilton, Vancouver Sun, Feb. 13/59). "The sedimentary section is reported to be thick, the structures prolific in number and giant in size. That's an unbeatable combination for a virgin exploration area." (Myers, Feb. 20/59). "Geological conditions make it reasonable to expect valuable accumulations of petroleum and natural gas may be found." (Economic Geology, p.10) "Speaking of the Canadian Arctic Islands in general, but specifically including the Parry Islands Fold Belt and the Arctic Coastal Plain, the same authors (i.e. Fortier, McNair and Thorsteinson) conclude that 'several large areas appear to have similarities to other regions that produce, or have in reserve, large quantities of petroleum'." (Taylor Vol. "A", p. 84, and Fortier et al 1954, p. 2103). (N.B.: Taylor includes the Sverdrup Basin in the Arctic Coastal Plain. See Vol. "A" of his Excerpts, p. 56). In this sense the Arctic Coastal Plain includes the north coasts of Melville and Bathurst Islands, and all of Borden and Mackenzie King Islands, and no doubt also all of Emerald Isle. (See Taylor Vol. "A", p. 56). "..... many air photographs exhibit folds that might be favourable structures." (A.S.P.G. Bull. Vol. 38/10 - p. 2103) (Fortier et al). "..... interest has been increasing in the potential oil and natural gas resources of the large areas of fossiliferous sedimentary rocks of the islands ....." (Economic Geology, p. 438).

"There are several references in the literature to the occurrence of petroliferous rock on Melville Island." "R. W. Ellis has commented that among these specimens collected ..... on the beach of Melville Island were some rich black shales which kindled readily into flame when ignited with a match." (Taylor Vol. 8, pp 20-23).

"Piercement domes lend weight to the petroliferous potentialities of the area". (Taylor Vol. "B", p. 10). "These structures strongly suggest interesting petroliferous deposits in this sector comparable to occurrences along the Gulf Coast of Texas." (Taylor's Brochure, p. 7). Forty of these piercement domes have been counted in the Sverdrup area, and the literature in some instances refers to them as salt domes.

Following excerpts are from the Oil & Gas Journal, Feb. 2/59. "Along the Texas coast there are 17 such (salt) domes, each of which has produced over fifty million barrels of oil. Twelve have produced over ninety million barrels each." ".... 90 to 95% pure salt. As for the 5 to 10% of impurities, most of this is anhydrite. These impurities are often left near the top of the dome as water dissolves the salt." "At lesser depths this material takes up water and becomes gypsum." (N.B.: In the Arctic the core at surface is reported to be anhydrite and gypsum.)

The Gulf of Mexico domes cover a distance of about 225 to 250 miles from north to south, and 500 miles from east to west. In the Sverdrup area the long axis of the piercement dome region is reported to extend from Sabine Peninsula on Melville Island to a piercement dome on the west coast of Axel Heiberg Island, a distance of about 300 miles. The area of the domes is reported to be "broad". Assuming that they extend a distance of 100 miles northwesterly from the said long axis, then the piercement dome area would include the whole of Borden Island, Mackenzie King Island and Emerald Isle, and it is suggested therefore that the very thick sedimentary beds of those islands would be a logical place for the discovery of piercement domes by geophysical means.







Then again quoting from the said Oil and Gas Journal: "Ocean water contains about 3.5% salt. As it evaporates in basins only slightly connected with the main water body, mineral content concentrates. First to crystallize is calcium carbonate or limestone; then calcium sulfate or anhydrite; third, halite or rock salt, and last to crystallize are several minerals such as those from which potash fertilizer is made." In the Gulf area ".....several salt mines are currently producing the salt itself from the top of some of these domes." "Oil and gas migrate to these upturned beds around and over the dome." (Oil and Gas Journal, Feb.2/59, Vol. 57, No.6, pp 138 sqq).

Hundreds of millions of barrels of oil and large reserves of gas and condensates have been discovered on and around previously known piercement type salt domes of the Texas Louisiana Gulf Coast." (Fourth World Petroleum Congress, June 1955, Section 1/A/1 Paper 4, p.84). The same paper reports "The Spindletop dome has produced 135,300,000 barrels of oil from 430 proven acres, and is still producing." And also "...oil and gas reserves known to exist in every piercement type salt dome in the Texas Louisiana Gulf Coast."

COAL. On Banks and Bathurst Islands there are widespread seams up to 30 feet thick. On Trans-Western's Cameron Island and its part of Melville Island there are widespread thin seams. (Ec. Geol. pp 440-441).

GYPSUM. This occurs among other places in sequence 600 feet thick or so between northern Melville Island and northern Ellesmere Island. It is found mainly in widespread diapir folds and piercement domes. (Ec. Geol. p. 439).

SULPHUR. Native sulphur occurs in association with Calcite in the Gypsum of a diapir fold on Western Axel Heiberg Island. (Ec. Geol. p.441). Possibly sulphur will be found in others of the piercement domes and diapir folds in the Sverdrup Basin.

#### FAUNA AND FLORA

ANIMALS. Among the mammals found in quantity on or around the Arctic Islands are:- Polar bears, seals, foxes, muskoxen, caribou, wolves, lemmings, hares, weasels, walrus and whales (in the Beaufort Sea.). (Arctic from the Air, p.20). Muskoxen have been reported in sizeable herds on Melville and other islands. Caribou are found on most of the Queen Elizabeth Islands. (Taylor's Brochure, p. 18).

BIRDS. These abound in summer. Large numbers of ducks and geese breed in the area on islands including Banks Island. Many birds nest in the islands. On the northern tip of Ellesmere, a few of these are geese, eider duck, auks, gulls, ptarmigan, plovers, terns and buntings. (Taylor's Brochure, p. 19).

FISH. Fish abound in lakes and rivers as far north as Alert, the most northerly part of these islands. Char (salmon-type) is the chief fish and is found in salt water and fresh water, and is extremely good eating. (Taylor's Brochure, p. 19).

VEGETATION. This includes berry bushes, scrub willows, grasses, moss, lichens and bright flowers. Many berries are edible. (Arctic from the Air, p. 19).

#### MARKETS

"Ironically, the most northerly of these areas - the Arctic Islands - may be the area closest and most accessible to major outlets through the future development of submarine tanker transportation." (Oilweek, Apr. 3/59).

The disadvantage of land locked crude as against "tanker" crude is obvious and submarine tankers could be more economic than surface tankers.

Economic transport of oil by surface tanker scores advantages over pipelines at many ocean port markets. Producers in Canada now fear tanker competition via the St. Lawrence Seaway in mid-continent areas. "Another threat as seen by Mr. Lee (of Western Decalta Pete.) is the St. Lawrence Seaway. He said it would now be possible for ocean going tankers to bring distress oil.....as far as Toronto, or even the Lake Head. This could be done at prices which couldn't be matched by western producers using the Inter-provincial Pipeline." (Ron Kennedy, Calgary Herald, April 24/59).







While the above relates to "distress" oil, that oil is "distress" in part because the wells at its source are large. Assuming large Arctic Islands wells, oil from the area could compete in the North American interior with foreign tanker-borne crude. With North American tariffs and quotas of course the Arctic oil would have additional advantages.

Eastern Hemisphere exporting fields (Middle East, Sahara, Indonesia, etc.) have to share the common market with Russia and the Caribbean exporters, and aggregate production exceeds the total consumption in worsening degree. Russia will be an increasing factor as she completes her pipelines to the Baltic ports.

The Arctic Islands having tanker access to, and being within Canada, will doubtless enjoy a protected Canadian market and probably an increasingly protected market in U.S.A. as the margin of U.S.A. reserves declines. Costs of U.S.A. discovery are rising, and fruits of exploration are declining. That decline in reserves will be accelerated under the quota import system now in effect. The Arctic Islands are strategically located. The distance to the European market is 3000 miles as against 8000 miles from the Persian Gulf to that market. Arctic oil can flow north of Greenland on its short way to Europe, and in the other direction south to the North American Atlantic Seaboard.

#### OFFSHORE SHIPMENT OF NATURAL GAS

The following is quoted from a paper delivered by Carl O. Nickle, former Member of the Canadian Parliament and Calgary oil executive, on "The Future for Western Canada's Oil and Gas", delivered on April 23/59 to the Canadian Petroleum Tax Society at Calgary. "The recent successful transfer of Louisiana Natural Gas in form of liquid methane, via the experimental tanker 'Methane Pioneer' to Britain, has opened a new branch of the world petroleum industry..... Vice-chairman, William R. Connole of the U.S. Federal Power Commission recently said: 'Every cost estimate I have seen concludes that natural gas from abroad can compete with pipeline gas in the densely populated coastal United States. The only question seems to be how much competition and how soon'. The same can be said for areas of Canada that can be served by tanker. A supply to Britain from a 500 million cubic feet daily gas liquification plant now proposed in Venezuela will presumably be the first large-scale application of the 'Liquified Methane' transport system. But, over the next few years, far broader application is now predicted."

Thus, it is obvious that assuming commercial production of gas in the great formations in the Canadian Arctic Islands, gas could be exported commercially, and could anticipate such political action as might be necessary to protect its market in North America.

#### POLITICAL ASPECTS

The only politically safe source for the maintenance of reserves available to U.S.A. is Canada. We find the eight countries of the Arab block, including Iraq, launching a long range campaign for bigger shares of oil profits. They plan to build their own pipelines and tankers. The Arabian-Japanese Oil Company gives to Kuwait and Saudi Arabia 56% of net profits down to retail distributors. Iraq has a strong communistic influence in its government, and is accepting armaments and commercial assistance with supervision from Russia. Venezuela has been invited to join with the Arabs in united plans to get more for their oil. Morocco also is dealing with the Arabs. (Arnott, Calgary Herald, April 7/59.)

Canadian Government policy obviously is to encourage northern oil and gas development. Regulations are in process of being amended to favour these Arctic Islands, and indications are that Government will do whatever is necessary to assist the economics of the area.

The proposed amendments are among other things, to allow in the Arctic Islands six years instead of three to earn credit for the standard amount of exploratory work which applies in the North West Territories and the Yukon. This would enable the permit holder to hold acreage for half the cost per acre per year for these first six years, and thus such costs, in all other parts of Canada, would be double or more.

We are losing our grip on the Middle East. Suez pointed up the danger of any long term dependance on Middle East oil. The Arab Republic and the U.S.S.R. are contesting control of Iraq. This could be the entering wedge for warm water harbours for the U.S.S.R. on the Indian Ocean. Russia also is threatening Iran over its pact with the







West. Venezuela is demanding what appears to be 60% of oil profits, and which can work out to an even higher levy, instead of the traditional 50%. (See Oil & Gas Journal, Dec. 29/58, p. 83).

#### CONCLUSION

The foregoing data indicates that Canada's Arctic Islands Sedimentary Basin has strategic, political, market and economic advantages, and that the area now is on the threshold of great exploration for oil and gas.

\*\*\*\*\*

#### BIBLIOGRAPHY

1. Taylor's Brochure: "Our Polar Islands - The Queen Elizabeths" (June 1956) by Andrew Taylor, P. Eng.
2. Taylor's Vols. "A" and "B" and 1 to 12: "The Physical Geography of the Queen Elizabeth Islands" by Andrew Taylor, P. Eng. published in 1956 in 12 Vols. by the American Geographical Society, New York. Vols. of photostatic excerpts designated by volumes as above, are in Trans-Western's library. This work followed scanning by Taylor of 30,000 aerial photos which now cover these islands.
3. Ec. Geol. "Economic Geology Series No. 1 (4th Edition). Geology and Economic Minerals of Canada. (1957)". Geol. Survey of Canada, edited by C. H. Stockwell. (\$2.00).
4. "Geological Unity of the Arctic Islands", (and the aeromagnetic survey described therein) by Fortier and Morley: "Ocean Floors around Canada", Transactions of Royal Society of Canada, Vol. L. Series III: June 1956.
5. "Geographical Discovery and Exploration, Queen Elizabeth Islands", by Andrew Taylor, P.E.
6. "Arctic Canada from the Air" - A Volume of maps, pictures and descriptions of all the Arctic Islands, by Dunbar & Greenaway. Available from Queen's Printer, Ottawa, and from De Mills Book Shop, Calgary. (\$8.00).
7. Arctic articles, prospects of huge wells, sub-tankers, sub-ice trade routes, geology, etc., in Myers Oilweek, Feb. 27/59 and Apr. 3/59.
8. Articles by officers of U.S.S. Nautilus re submarine tankers, sub-ice navigation, trade routes across the Arctic, etc. National Geographic, Jan. 1959.
9. Projected air travel grid for Arctic Archipelago. Financial Post, March 14/59, p. 23.
10. Vols. 6 & 7 "Arctic Bibliography prepared for and in co-operation with the Dept. of Defense under the Direction of the Arctic Institute of North America." Available at office of Trans-Western. These volumes contain several thousand items in various languages.
11. Other Arctic Literature - see Bibliographies attached to T.-W.'s "Outline of the Arctic Islands Project", and T.-W.'s "Geological Notes."



[illegible]

PRINTED IN U. S. A.

JAN 29 1979  
APR 1979

4383

Quetzil

Pam 622.323 : (\*40)